

What Is Claimed Is:

1. A high electron mobility transistor using a Group III-V compound semiconductor, comprising
- 5 an undoped second channel layer laminated on an InP substrate via a buffer layer;
- an undoped first channel layer laminated on said second channel layer; and
- 10 a doped electron-supplying layer laminated on said first channel layer,
- wherein said first channel layer is composed of $\text{In}_{1-x}\text{Ga}_x\text{As}$ and has an energy level of conduction band lower than that of said electron-supplying layer,
- said second channel layer is composed of a Group
- 15 III-V compound semiconductor using a Group V element other than P, has an energy level of conduction band higher than that of the first channel layer, and has a band gap wider than that of the first channel layer.
- 20 2. The high electron mobility transistor as described in claim 1, wherein said first and second channel layers are formed to have a thickness small enough to have discrete quantum levels, a first quantum level being formed only in the first channel layer, and a second
- 25 quantum level being formed in both the first and second channel layers.

3. The high electron mobility transistor as described in claim 1 or claim 2, wherein said electron-supplying layer is composed of $\text{In}_{1-y}\text{Al}_y\text{As}$, the first channel layer is composed of $\text{In}_{1-x}\text{Ga}_x\text{As}$, and the second
5 channel layer is composed of $\text{In}_{1-x}(\text{Al}_{1-z}\text{Ga}_z)_x\text{As}$.

4. The high electron mobility transistor as described in claim 1 or claim 2, wherein said electron-supplying layer is composed of $\text{In}_{1-y}\text{Al}_y\text{As}$, the first
10 channel layer is composed of $\text{In}_{1-x}\text{Ga}_x\text{As}$, and the second channel layer is composed of $\text{In}_{1-x}(\text{Al}_{1-z}\text{Ga}_z)_x(\text{As}_{1-z_2}\text{Sb}_{z_2})$.

5. The high electron mobility transistor as described in claim 3 or claim 4, wherein the thickness of
15 said first channel layer is 3~7 nm.

6. The high electron mobility transistor as described in claim 3 or claim 4, wherein the thickness of said second channel layer is 10~20 nm.

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7. The high electron mobility transistor as described in claim 3 or claim 4, wherein the composition ratio (1-z) of Al element in said second channel layer is 0.05~0.5.

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8. The high electron mobility transistor as described in claim 1 or claim 2, wherein said electron-

supplying layer is composed of $\text{In}_{1-y}\text{Al}_y\text{As}$, the first
channel layer is composed of $\text{In}_{1-x}\text{Ga}_x\text{As}$, and the second
channel layer is composed of $\text{In}_{1-x}\text{Ga}_x\text{As}$ with the In
composition ratio lower and the gallium composition ratio
5 higher than those in the first channel layer.

9. The high electron mobility transistor as
described in claim 1 or claim 2, wherein an element
separation groove is formed which extends from said
10 electron-supplying layer to said buffer layer.

10. A high electron mobility transistor using a
Group III-V compound semiconductor, comprising
an undoped second channel layer laminated on an
15 InP substrate via a buffer layer and composed of $\text{In}_{1-x}(\text{Al}_{1-z}\text{Ga}_z)_x\text{As}$ (where the composition ratio $(z-1)$ of Al is
0.05~0.5) which is lattice matched to InP,
an undoped first channel layer laminated on said
second channel layer and composed of $\text{In}_{1-x}\text{Ga}_x\text{As}$ which is
20 lattice matched to InP, and
a doped electron-supplying layer laminated on
said first channel layer and composed of $\text{In}_{1-y}\text{Al}_y\text{As}$ which
is lattice matched to InP.

25 11. The high electron mobility transistor as
described in claim 10, wherein said first and second
channel layers are formed to have a thickness small enough

to have the discrete quantum levels, a first quantum level being formed only in the first channel layer, and a second quantum level being formed in both the first and second channel layers.

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